REMARKS

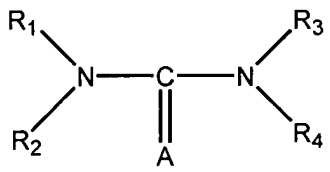
This paper is being provided in response to the August 6, 2003 Office Action for the above-referenced application. No claims have been amended herein.

The rejection of claims 10-14 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,981,454 (hereinafter referred to as "Small") in view of U.S. Patent No. 6,068,000 (hereinafter referred to as "Tanabe") is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims are patentable over the cited references.

Claim 10 recites stripping a resist film on a semiconductor wafer having an exposed metal film, by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, (c) a hydroxylamine, (d) water and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Claim 11 recites stripping a resist film on a semiconductor wafer having an exposed metal film, by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, (c) a hydroxylamine, (d) water and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. The amounts of the components (a), (b), (c) and (d) are 1 to 60% by mass, 0.1 to 20% by mass, 5 to 70% by mass and 2 to 40% by mass, respectively. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Claim 12 recites stripping a resist film on a semiconductor wafer having an exposed metal film, by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. The component (a) is a compound represented by the following general formula (1):



(1)

R1, R2, R3 and R4 are each independently a hydrogen atom or an alkyl group having 1 to 3 carbon atoms, and A is an oxygen atom or a sulfur atom. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Claim 13 recites stripping a resist film on a semiconductor wafer having an exposed metal film, by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, having a benzene derivative having at least two phenolic hydroxyl groups in the molecule, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Claim 14 recites stripping a resist film on a semiconductor wafer having an exposed metal film, by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. The component (b) is a benzene derivative having at least two phenolic hydroxyl groups in the molecule having

at least one compound selected from the group consisting of pyrogallol, hydroxyhydroquinone, fluoroglucinol, gallic acid and tannic acid. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Small discloses a composition for removal of chemical residues from metal or dielectric surfaces or for chemical mechanical polishing of a copper surface. (See Abstract; Col. 2, Lines 37-40). The residues removed are either particulates or post etch residue such as chemicals that may cause corrosion if not removed. The solution used is aqueous with an acidic nature with various salts, acids and amines added to make the solution into an oxidizing material. (Col. 3, Line 40-Col. 4, Line 25).

Tanabe discloses a substrate treatment method performed after forming the resist pattern on a substrate and etching the resist. (See Abstract; Col. 1, Lines 5-15). Tanabe discloses using a rinsing solution of water and a water-soluble organic solvent after a removing treatment using a hydrofluoric acid-based remover solution. (Col. 2, Lines 36-44; Col. 3, Lines 3-8). Tanabe discloses that an additional anticorrosive may be included in the lithographic rinsing solution. (Col. 6, Lines 10-18).

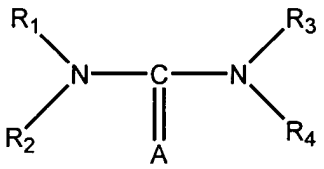
Applicants respectfully submit that independent claims 10-14 are not obvious over Small in view of Tanabe. Each of these claims recites that the urea (component (a)) and the hydroxyaromatic compound (component (b)) supplement each other to form a coating layer that imparts hydrophobicity to the exposed metal film.

Small discloses gallic acid (a hydroxyaromatic compound) as one of a number of possible acid components of his composition (plus a very large number of derivatives and other compounds). Urea hydroperoxide is disclosed as one of a number of possible oxidizing components (although hydroxylamine is disclosed to be the preferred oxidizer, and is the only oxidizer used in the examples). There is no suggestion or disclosure that gallic acid (or any other hydroxyaromatic compound) can combine with urea hydroperoxide (or any other urea

compound) to form a coating layer that imparts hydrophobicity to the exposed metal film, as disclosed and claimed in claims 10-14.

The Office Action suggests that if one of ordinary skill in the art were to select gallic acid and urea hydroperoxide according to the teachings of Small, a coating layer that imparts hydrophobicity to the exposed metal film would inherently be formed. This contention ignores the fact that hydroperoxides are highly hydrophilic, and thus are unlikely to form a hydrophobic coating. Urea or a different urea derivative, such as one of the many disclosed in the present application, would have to be used in order to achieve this claimed result, and there is no suggestion in Small of any substitution of different urea derivatives. In fact, substitution of a different urea derivative would defeat the purpose of Small, since the hydroperoxide component of urea hydroperoxide is responsible for its nature as an oxidizer.

In addition, urea hydroperoxide is not a compound of the form



wherein R_1, R_2, R_3, and R_4 are each independently a hydrogen atom or an alkyl group having 1 to 3 carbon atoms, as recited by claim 12, and nothing in Small suggests the substitution of a compound of that formula for urea hydroperoxide.

The Office Action further suggests that urea hydroperoxide is anticorrosive, pointing to language in Small indicating that it is important not to etch metal features on the wafer. Applicants point out that nothing in Small suggests *anticorrosive* (*i.e.*, protective) properties for urea hydroperoxide; at best, it suggests that urea hydroperoxide should be used in small enough quantities that it is *noncorrosive*.

The deficiencies of Small are not remedied by Tanabe. The latter reference is relied upon solely to teach the use of a water-soluble organic solvent. Since Tanabe does not teach or suggest the use of urea or hydroxyaromatic compounds at all, it does not teach or suggest that

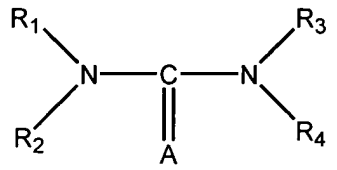
these compounds be used to improve anticorrosive properties. Thus, Small and Tanabe do not render the claimed invention obvious, whether taken separately or in combination.

The rejection of claims 16-20, 22-26, 28, and 29 under 35 U.S.C. §103(a) as being obvious over Small in view of Tanabe and U.S. Patent No. 6,204,192 (hereinafter referred to as "Zhao") is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims, as amended herein, are patentable over the cited references.

Claim 16 recites forming on a semiconductor wafer, a metal film and an insulating film in this order, forming a resist film thereon, and conducting dry etching with the resist film being used as a mask, to form, in the insulating film, dents reaching the metal film. The resist film and/or the residue of etching are then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, (c) a hydroxylamine or an alkanolamine, (d) water, and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 17 recites forming, on a semiconductor wafer, a metal film and an insulating film in this order, forming a resist film thereon, and conducting dry etching with the resist film being used as a mask, to form, in the insulating film, dents reaching the metal film. The resist film and/or the residue of etching are then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, (c) a hydroxylamine or an alkanolamine, (d) water, and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. The amounts of the components (a), (b), (c) and (d) are 1 to 60% by mass, 0.1 to 20% by mass, 5 to 70% by mass and 2 to 40% by mass, respectively. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 18 recites forming, on a semiconductor wafer, a metal film and an insulating film in this order, forming a resist film thereon, and conducting dry etching with the resist film being used as a mask, to form, in the insulating film, dents reaching the metal film. The resist film and/or the residue of etching are then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. The component (a) is a compound represented by the following general formula (1):



(1)

(R1, R2, R3 and R4 are each independently a hydrogen atom or an alkyl group having 1 to 3 carbon atoms; and A is an oxygen atom or a sulfur atom). Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 19 recites forming, on a semiconductor wafer, a metal film and an insulating film in this order, forming a resist film thereon, and conducting dry etching with the resist film being used as a mask, to form, in the insulating film, dents reaching the metal film. The resist film and/or the residue of etching are then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative and (b) a hydroxy aromatic compound, having a benzene derivative having at least two phenolic hydroxyl groups in the molecule, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

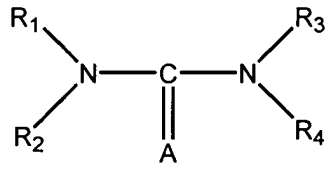
Claim 20 recites forming, on a semiconductor wafer, a metal film and an insulating film in this order, forming a resist film thereon, and conducting dry etching with the resist film being used as a mask, to form, in the insulating film, dents reaching the metal film. The resist film and/or the residue of etching are then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. The component (b) is a benzene derivative having at least two phenolic hydroxyl groups in the molecule having at least one compound selected from the group consisting of pyrogallol, hydroxyhydroquinone, fluoroglucinol, gallic acid and tannic acid. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 22 recites forming, on a semiconductor wafer, a metal film, a first insulating film and a second insulating film having desired openings, and conducting dry etching with the second insulating film being used as a mask, to form, in the first insulating film, dents reaching the metal film. The residue of etching is then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, (c) a hydroxylamine or an alkanolamine, (d) water and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components, wherein components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 23 recites forming, on a semiconductor wafer, a metal film, a first insulating film and a second insulating film having desired openings, and conducting dry etching with the second insulating film being used as a mask, to form, in the first insulating film, dents reaching the metal film. The residue of etching is then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy

aromatic compound, (c) a hydroxylamine or an alkanolamine, (d) water and (e) a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. The amounts of the components (a), (b), (c) and (d) are 1 to 60% by mass, 0.1 to 20% by mass, 5 to 70% by mass and 2 to 40% by mass, respectively. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 24 recites forming, on a semiconductor wafer, a metal film, a first insulating film and a second insulating film having desired openings, and conducting dry etching with the second insulating film being used as a mask, to form, in the first insulating film, dents reaching the metal film. The residue of etching is then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. The component (a) is a compound represented by the following general formula (1):



(1)

(R1, R2, R3 and R4 are each independently a hydrogen atom or an alkyl group having 1 to 3 carbon atoms; and A is an oxygen atom or a sulfur atom). Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 25 recites forming, on a semiconductor wafer, a metal film, a first insulating film and a second insulating film having desired openings, and conducting dry etching with the second insulating film being used as a mask, to form, in the first insulating film, dents reaching the metal film. The residue of etching is then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative and (b) a hydroxy

aromatic compound, having a benzene derivative having at least two phenolic hydroxyl groups in the molecule, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones, as essential components. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claim 26 recites forming, on a semiconductor wafer, a metal film, a first insulating film and a second insulating film having desired openings, and conducting dry etching with the second insulating film being used as a mask, to form, in the first insulating film, dents reaching the metal film. The residue of etching is then stripped by using a stripper composition containing an anticorrosive agent which contains (a) urea or a urea derivative, (b) a hydroxy aromatic compound, and a water soluble organic solvent selected from the group including sulfoxides, dimethylformamides, dimethyl acetamides, glycols, glycol ethers, pyrrolidones, imidazolidinones as essential components. The component (b) is a benzene derivative having at least two phenolic hydroxyl groups in the molecule having at least one compound selected from the group consisting of pyrogallol, hydroxyhydroquinone, fluoroglucinol, gallic acid and tannic acid. Components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film.

Claims 28 and 29 depend from claims 10 and 11, respectively, and recite the additional limitation that the metal film is a copper film.

Small and Tanabe are as discussed above. Zhao is relied upon to show that the steps of patterning the dielectric layer to expose the metal layer included in the steps of forming a metal film, first dielectric film and resist or second dielectric film, and etching the first dielectric layer using the resist film as a mask to expose the metal layer are known in the art.

Applicants respectfully submit that claims 16-20, 22-26, 28, and 29 are not obvious over Small in view of Tanabe and Zhao. As discussed above, Small and Tanabe do not teach or suggest combining urea or a urea derivative and a hydroxyaromatic compound that supplement

each other to form a coating layer that imparts hydrophobicity to an exposed metal film. Further, Small and Tanabe do not teach or suggest the specific urea derivatives recited in claims 18 and 24.

These deficiencies are not remedied by Zhao, which is relied upon to teach methods of patterning dielectric layers, and which does not disclose any stripping compositions related to the present invention. Thus, Applicants respectfully submit that Small, Tanabe, and Zhao do not render the claimed invention obvious, whether taken separately or in combination.

The rejection of claims 10-14 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,885,362 (hereinafter referred to as "Morinaga") in view of Tanabe is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims, as amended herein, are patentable over the cited references.

Claims 10-14 and Tanabe are as discussed above.

Morinaga describes a method for cleaning substrates using various hydroxys, urea and water. The cleaning composition of Morinaga comprises these complexing agents as inhibitors of metal deposition. The complexing agents inhibit the deposition of metal impurities from the cleaning solution onto the wafer surface ("reverse contamination") (col. 2, lines 5-7; col. 3, lines 5-11). The reference discloses materials to remove etching residues and contamination such as particles, and does not suggest stripping resists or other organic layers with exposed metal.

Applicants respectfully submit that independent claims 10-14 are not obvious over Morinaga in view of Tanabe.

As discussed above, claims 10-14 all specify that components (a) and (b) supplement each other to form a coating layer that imparts hydrophobicity to the metal film. Morinaga fails to teach such an effect. Since the purpose of the complexing agents of Morinaga is to remain in solution, preventing metal atoms from being deposited on the surface, they are present only in small enough quantities to avoid deposition on the surface. In fact, Morinaga specifically states

that if the amount of complexing agent is too large, "there is a fear that the complexing agent as a metal deposition preventative tends to be unfavorably deposited on the surface." Col. 12, lines 47-51. (The Office Action appears to suggest that this is a caution against depositing metal on the surface; in fact, it is clearly a caution against depositing the complexing agent, which may also have associated metal ions).

In contrast, components (a) and (b) according to the invention are present in sufficient amounts to form a coating layer on the surface that imparts hydrophobicity. Increasing the amounts of the complexing agents of Morinaga to concentrations that formed a surface coating would defeat the purpose of that reference; thus, it cannot be considered obvious to adjust the quantities of the complexing agents to obtain the recited invention. *See* MPEP 2143.01, citing In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984) ("If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification").

The Office Action suggests that the treatment of Morinaga *must* include the formation of a protective layer, because simply it may contain the same components as the present invention. This ignores the clear teaching of Morinaga that the composition must be dilute, so as to *avoid* forming such a layer. Col. 12, lines 37-51.

These deficiencies of Morinaga are not remedied by Tanabe. Tanabe is relied upon solely to teach the addition of a water-soluble organic solvent. It makes no suggestion that a protective film should be formed on the surface, nor does it provide any other motivation to adjust the Morinaga reference to obtain the claimed invention. Thus, Morinaga and Tanabe do not render the claimed invention obvious, whether taken separately or in combination.

The rejection of claims 16-20, 22-26, 28, and 29 under 35 U.S.C. §103(a) as being obvious over Morinaga in view of Tanabe and Zhao is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims, as amended herein, are patentable over the cited references.

The claims and cited references are all discussed above. Applicants respectfully submit that claims 16-20, 22-26, 28, and 29 are not obvious over Morinaga in view of Tanabe and Zhao.

As discussed above in connection with claims 10-14, Morinaga and Tanabe contain no suggestion or teaching that urea and hydroxyaromatic compounds should be combined in order to form a protective film on the metal surface, as required by each of the rejected claims. This deficiency is not remedied by Zhao, which is relied upon solely to teach the process of patterning a dielectric layer to expose a metal film, and contains no disclosure or suggestion that urea and hydroxyaromatic compounds may be beneficially combined to yield superior anticorrosive properties. Thus, Morinaga, Tanabe, and Zhao do not render the claimed invention obvious, whether taken separately or in combination.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4038.

Respectfully submitted,
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